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Psychotic experiences, psychiatric comorbidity and mental health need in the general population: a cross-sectional and cohort study in Southeast London

Vishal Bhavsar[1,2,*], Sarah Dorrington[2,3,*], Craig Morgan[4], Stephani L. Hatch[3], Philip McGuire[1], Paolo Fusar-Poli[5,6,7], John Mills[1], James H. MacCabe[1,2] and Matthew Hotopf[2,3]

[1]Department of Psychosis Studies, Institute of Psychiatry Psychology and Neuroscience, King's College London, London, UK; [2]South London and Maudsley NHS Foundation Trust, London, UK; [3]Department of Psychological Medicine, Institute of Psychiatry Psychology and Neuroscience, King's College London, London, UK; [4]Department of Health Services and Population Research, Institute of Psychiatry Psychology and Neuroscience, King's College London, London, UK; [5]Early Psychosis: Interventions and Clinical-Detection (EPIC) lab, Department of Psychosis Studies, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, UK; [6]OASIS Service, South London and Maudsley NHS Foundation Trust, London, UK and [7]Department of Brain and Behavioural Sciences, University of Pavia, Pavia, Italy

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*Joint first authors.

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Author for correspondence:
Vishal Bhavsar,
E-mail: Vishal.2.bhavsar@kcl.ac.uk

Abstract

Background. Co-occurrence of common mental disorders (CMD) with psychotic experiences is well-known. There is little research on the public mental health relevance of concurrent psychotic experiences for service use, suicidality, and poor physical health. We aim to: (1) describe the distribution of psychotic experiences co-occurring with a range of non-psychotic psychiatric disorders [CMD, depressive episode, anxiety disorder, probable post-traumatic stress disorder (PTSD), and personality dysfunction], and (2) examine associations of concurrent psychotic experiences with secondary mental healthcare use, psychological treatment use for CMD, lifetime suicide attempts, and poor self-rated health.

Methods. We linked a prospective cross-sectional community health survey with a mental healthcare provider database. For each non-psychotic psychiatric disorder, patients with concurrent psychotic experiences were compared to those without psychotic experiences on use of secondary mental healthcare, psychological treatment for CMD, suicide attempt, physical functioning, and a composite multimorbidity score, using logistic regression and Cox regressions.

Results. In all disorders except for anxiety disorder, concurrent psychotic experiences were accompanied by a greater odds of all outcomes (odds ratios) for a unit change in composite multimorbidity score ranged between 2.21 [95% confidence interval (CI) 1.49–3.27] and 3.46 (95% CI 1.52–7.85). Hazard ratios for secondary mental health service use for non-psychotic disorders with concurrent psychotic experiences, ranged from 0.53 (95% CI 0.15–1.86) for anxiety disorders with psychotic experiences to 4.99 (95% CI 1.22–20.44) among those with PTSD with psychotic experiences.

Conclusions. Co-occurring psychotic experiences indicate greater public mental health burden, suggesting psychotic experiences could be a marker for future preventive strategies improving public mental health.

Introduction

Self-reported psychotic experiences such as hearing voices, experiencing paranoid thoughts, are common in the general population. These experiences have been conceptualised as existing on a continuum with psychotic illness (Linscott and van Os, 2013), although this has been challenged (Parnas and Henriksen, 2016). Psychotic experiences are distinct from clinically detectable attenuated psychotic symptoms reported by help-seeking individuals (Fusar-Poli *et al.*, 2016). Self-reported psychotic experiences in non-psychotic psychiatric disorders could be an indicator of greater illness severity or poorer healthcare outcomes compared with experiencing the same disorders without psychotic experiences. Nonetheless, although there exists a large literature on general population co-occurrence of psychotic experiences with other psychiatric disorders, including depression (Koyanagi *et al.*, 2016), anxiety (Kelleher *et al.*, 2014), post-traumatic stress disorder (PTSD) (Kilcommons *et al.*, 2008), and personality disorders (Newton-Howes *et al.*, 2008), there has been more limited examination of the implications of this comorbidity for public mental health. In particular,

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co-occurrence of psychotic experiences with non-psychotic psychiatric disorders could indicate greater psychopathological symptom burden, worse overall prognosis in terms of later use of health services, worse longer term functioning, or specific implications for physical health (Sharifi *et al.*, 2015; Scott *et al.*, 2018; Oh *et al.*, 2019), or suicide (Kelleher *et al.*, 2012). People with psychotic experiences present more frequently to specialist mental health services than the general population (Kobayashi *et al.*, 2011; Murphy *et al.*, 2012; DeVylder *et al.*, 2014*b*), however information on use of psychological treatment for common mental disorders (CMDs) is more limited (Perez *et al.*, 2018). Psychiatric symptoms reported in general population surveys are also associated with worse physical health and functioning (Phelan *et al.*, 2001; Moreno *et al.*, 2013) and health-related quality of life (Alonso *et al.*, 2018). However, although the possible relevance of psychotic experiences for physical health has been examined in large-scale epidemiological data (Saha *et al.*, 2011; Moreno *et al.*, 2013), the effect of psychotic experiences concurrent with non-psychotic psychiatric disorders on physical functioning has received a limited amount of attention.

We therefore aim (1) to describe the distribution of self-reported psychotic experiences co-occurring with a range of non-psychotic psychiatric disorders, and (2) to examine the association of these comorbid psychotic experiences with outcomes of public health importance: use of secondary mental healthcare, use of psychological treatment for CMDs, lifetime suicide attempts, and poor self-rated health.

Methods

Sample details

This study linked a cross-sectional community health survey with a mental healthcare provider database. The South East London Community Health Study, SELCoH (Hatch *et al.*, 2011), is a representative household survey whose first wave (SELCoH-1) took place in 2008–2010. The survey used random household sampling to identify a representative sample of adults aged 16–90 years living in Lambeth and Southwark. Sampling was clustered by household, with all adults living in selected households invited to participate. Full details of the study, its sampling methods, and representativeness are described elsewhere (Hatch *et al.*, 2011). Among 1698 participants surveyed, 86% gave permission for linkage to specialist mental health records, where those records were available. Data on participants were linked to electronic health record data on use of mental health services both before and after SELCoH-1 interview (described further in the 'Outcomes' section). Data from SELCoH phase 2, a survey performed in 2012–2013 and based on the same sample, were used to ascertain which participants had subsequently left the catchment area or died (Hatch *et al.*, 2016).

Measurements

Psychotic experiences

The Psychosis Screening Questionnaire (PSQ) (Bebbington and Nayani, 1995) was used to assess psychotic experiences. This is a five-item self-report questionnaire which evaluates different psychotic experiences domains experienced in the previous year. These comprise: hypomania, strange experiences, paranoia, hallucinations, and thought disorder. Each domain contains an initial 'probe' item followed by secondary questions. Because the current study was focused on common psychiatric disorders co-occurring with non-affective psychotic experiences, responses to the hypomania item were not examined. Individuals were considered to have psychotic experiences if they endorsed one or more secondary items in the four remaining domains. The PSQ displays good correspondence with psychosis items on the Schedules for Clinical Assessment in Neuropsychiatry (Bebbington and Nayani, 1995), and has seen frequent use in population studies (Bebbington *et al.*, 2004).

Non-psychotic psychiatric disorders

CMDs were assessed by the Revised Clinical Interview Schedule (CIS-R) (Lewis *et al.*, 1992), giving a score out of 49 for symptoms occurring within the previous 4 weeks. In line with previous studies (Hatch *et al.*, 2016), we categorised scores into groups for scores of 0–11 (no CMD), 12–18 (mild/moderate symptoms of CMD), and over 18 (severe symptoms of CMD). Diagnoses of depressive episode and anxiety disorder were derived through a standard ICD-10 based algorithm. The anxiety disorder category included those with derived diagnoses of generalised anxiety disorder, obsessive-compulsive disorder, mixed anxiety and depression, specific phobia, social phobia, agoraphobia, generalised anxiety disorder, and panic disorder. Post-traumatic stress symptoms in the past month were assessed using the PC-PTSD (Prins *et al.*, 2003), a screening tool for PTSD designed for primary care use, which is based on the diagnostic criteria for PTSD in DSM-V. We used a cut-off point of 3 or more to define probable PTSD, which has been shown to have high specificity (0.88) and acceptable sensitivity (0.76) (Cameron and Gusman, 2003). Personality dysfunction (PD) was assessed using the Standardised Assessment of Personality-Abbreviated Scale (SAPAS), a rapid screen for personality disorder, which has demonstrated good psychometric properties (Moran *et al.*, 2003) and clinical utility (Bock *et al.*, 2010; Bukh *et al.*, 2010; Germans *et al.*, 2012). The SAPAS consists of eight questions, corresponding to descriptive statements about the person's usual behaviour, currently. Binary responses are summed to derive an overall score, for which a cut-off of 4 was used, which has showed satisfactory positive predictive value in community settings (Moran *et al.*, 2003).

Covariates

SELCoH-1 collected sociodemographic, environmental and health information. Ethnicity was operationalised as a five-category variable comprising white, black African, black Caribbean, Asian, and other groups. Marital status was categorised into single, married/cohabiting, divorced/separated, and widowed. Drug use information was ascertained by self-report of use of any illicit drug (cannabis, crack, cocaine, ecstasy, LSD, and heroin) in the previous year. Alcohol use patterns in the past year were measured using the AUDIT scale (Saunders *et al.*, 1993), using a cut-off of 8 to identify hazardous alcohol use, in line with previous studies.

Outcomes

Two indicators of mental health service use were used: specialist mental health service use, and use of psychological treatment for CMDs. Specialist mental health service use was ascertained using data from the National Institute of Health Research Biomedical Research Centre at the Maudsley's Clinical Record Interactive Search (CRIS) (Stewart *et al.*, 2009) system. The South London and Maudsley NHS Foundation Trust (SLaM) is

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the sole provider of public mental healthcare in the two boroughs of South London that were surveyed in SELCoH-1, covering a catchment population of approximately 620 000. The Trust has used a single electronic health record across all clinical services known as the electronic Patient Journey System (ePJS) since 2006. The CRIS system extracts de-identified clinical data from ePJS including structured fields for ICD-10 diagnoses, treatments and admissions to hospital. The Improving Access to Psychological Treatment (IAPT) programme is a national network of services providing psychological treatment for CMDs, spanning primary and secondary care. For this study, linkage of SELCoH-1 data was also carried out to IAPT-CRIS, an electronic system extracting de-identified clinical data from IAPTUS, the electronic system used by professionals providing IAPT-based treatment, which includes structured fields for ICD-10 diagnoses, treatments, and outcome.

Linkage of SELCoH-1 to CRIS and IAPT-CRIS was carried out by an independent Clinical Data Linkage Service (CDLS), and used personal identifiers (name, date of birth, NHS number, postcode, and gender) to probabilistically link survey data with matching electronic health records (Centre, 2015). Data on SELCoH-1 participants who had consented to record linkage were then scrutinised in CRIS and IAPT-CRIS for date of referral. This linked information was used to derive two binary variables for any specialist mental health service use (from CRIS), and any use of psychological treatment (from IAPT-CRIS), and two variables for survival analysis, for time to contact with specialist mental health services (from CRIS), and time to use of psychological treatment (from IAPT-CRIS). Referral information for this study was available from 1st April 1999 to 15th May 2017 for specialist mental health service use, and from 1st January 2008 until 31st November 2018 for use of psychological treatment.

Physical functioning was measured in SELCOH-1 using the physical component of the SF-12 (Ware and Kosinski, 2001), a 12 item scale capturing limitation in daily activities for physical health reasons in the previous 4 weeks. Poor physical functioning was a binary indicator based on the lowest quartile of the physical component score on the SF-12 (Das-Munshi *et al*., 2008). Finally, lifetime suicide attempt was evaluated using a self-report item in SELCoH-1.

Ethical approval

The SELCoH-1 study received approval from the King's College London research ethics committee, reference CREC/07/08-152. The CRIS data resource received ethical approval as an anonymised data set for secondary analyses from Oxfordshire REC C, reference 08/H0606/71+5.

Comorbidity

Non-psychotic psychiatric disorders were defined by dichotomising scales as described above. For each possible combination of psychotic experiences and non-psychotic psychiatric disorder, a four-level categorical variable was created, reflecting those with neither psychotic experiences nor disorder, disorder without psychotic experiences, psychotic experiences without disorder, and psychotic experiences and disorder. For example, the PTSD-psychotic experiences comorbidity variable had the following levels: (a) neither psychotic experiences nor PTSD, (b) PTSD only, (c) psychotic experiences only, and (d) both psychotic experiences and PTSD.

Analyses

All analyses were carried out in STATA 14 (StataCorp, 2014), and took account of survey design, household clustering, and non-response within households. Frequencies and prevalence of psychotic experiences were described within each non-psychotic psychiatric disorder, outcome, and all covariates. Frequencies and prevalence of each outcome were described for participants with each non-psychotic psychiatric disorder and concurrent psychotic experiences.

Binary outcomes for logistic regression modelling were: specialist mental health service use, use of psychological treatment, lifetime history of suicide attempt, and lowest-quartile of the SF-12 physical component score.

Logistic regressions were estimated for each pairing of non-psychotic psychiatric disorder and outcome. For each non-psychotic psychiatric disorder, we estimated odds ratios (ORs) for the association between that disorder and the outcome, the association of psychotic experiences with the outcome, and the additive interaction between the two, calculating the interaction contrast ratio (ICR, also referred to as the relative excess risk due to interaction) describing the extent of departure of the relationship between psychotic experiences and each non-psychotic psychiatric disorder from an additive relationship, and a likelihood ratio test to assess statistical evidence for departure of the relationship from additivity (a small p value indicating evidence of interaction). All models included age as continuous variable, gender, and ethnicity as *a priori* confounders. Marital status, drug use, and hazardous alcohol use were evaluated as potential confounders, and not included models as adjusted estimates did not change by greater 10% of the crude value, on inclusion of any of these variables (Greenland *et al*., 2016). Based on this approach, final models were adjusted for age, gender, and ethnic group.

Survival analysis

We also took information on all referrals to specialist mental health services, and to psychological treatment for CMDs occurring subsequently to the survey interview (Bhavsar *et al*., 2017), in order to test the association between experiencing non-psychotic psychiatric disorder with concurrent psychotic experiences and time to specialist mental health service use, and time to use of psychological treatment. After assessing proportionality of hazards with a statistical test based on Schoenfeld residuals, survey-weighted Cox regression analyses were conducted, evaluating the association of concurrent psychotic experiences on time to secondary mental healthcare use, adjusting for age, gender, and ethnic group. As for logistic regressions described, we estimated ICRs and likelihood ratio tests for interaction on the additive scale.

Results

Psychotic experiences were reported by 19.7% of the study population. Table 1 shows the socio-demographic and clinical associations of psychotic experiences. Psychotic experiences were less frequently reported in older participants, similarly distributed by sex, but more frequently reported by those who identified as black Caribbean or black African than other ethnic groups. Psychotic experiences were most common among single people, and least common among married/cohabiting respondents.

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Table 1. Non-psychotic psychiatric disorders, sociodemographic characteristics and outcomes by psychotic experiences (PE) status

	Overall *n* in category	Number with PE (%)
Age		
16–24	300	78 (25.8)
25–34	316	55 (17.9)
35–44	293	54 (18.4)
45–54	223	53 (24.0)
55–64	138	19 (13.8)
65+	146	15 (10.4)
Gender		
Male	615	126 (20.8)
Female	801	148 (18.7)
Ethnic group		
White	917	154 (17.2)
Black Caribbean	112	33 (29.1)
Black African	178	43 (24.4)
Asian	47	8 (16.3)
Other	162	36 (22.6)
Marital status		
Single	550	135 (24.8)
Married/cohabit	668	91 (13.7)
Divorced/separate	155	42 (27.4)
Widowed	43	6 (14.4)
Unemployment		
No	1272	225 (18.0)
Yes	139	139 (34.2)
Hazardous alcohol use[a]		
No	1117	199 (18.1)
Yes	298	75 (25.3)
Recent drug use[b]		
No	1101	183 (16.9)
Yes	315	91 (28.7)
CMD symptoms[c]		
No	1077	136 (13.0)
Mild/moderate	169	55 (33.5)
Severe	170	83 (49.2)
Depressive episode[d]		
No	1253	207 (17.0)
Yes	163	67 (41.1)
Anxiety disorder[d]		
No	1286	228 (18.0)
Yes	130	46 (36.1)
PTSD[e]		
No	1344	239 (18.1)
Yes	72	35 (50.1)
PD[f]		
No	1218	195 (16.4)
Yes	198	79 (40.4)
Secondary mental health service use[g]		
No	1231	205 (17.0)
Yes	185	69 (38.1)
Use of psychological treatment services[g]		
No	1227	227 (18.8)
Yes	189	47 (25.4)
Lifetime suicide attempt		
No	1307	228 (17.5)
Yes	109	46 (42.7)
Poor physical functioning[h]		
No	1162	188 (16.7)
Yes	254	86 (34.3)
Overall sample	1416	274 (19.7)

Percentages are weighted for survey design and non-response within households.
[a]Defined as scoring 8 or above on the AUDIT.
[b]Use of any of the following in the previous year: cannabis, cocaine, crack, opiates, amphetamines, ecstasy, and LSD.
[c]Based on scores on the Clinical Interview Schedule-Revised (CIS-R).
[d]Derived from items on the CIS-R.
[e]Derived from the PC-PTSD with a cut-off of 3.
[f]Derived from the SAPAS.
[g]Based on linkage to databases for specialist mental health records including secondary mental health services and use of psychological treatment services.
[h]Binary indicator based on the lowest quartile of the physical component score on the SF-12.

There was a noticeably higher prevalence of psychotic experiences with increasing symptoms. Similarly, psychotic experiences were reported more frequently in those experiencing every non-psychotic psychiatric disorder that was included in this study. Psychotic experiences were reported around a quarter of those with any use of psychological treatment for CMDs (25.4%), and nearly two-fifths of those with specialist mental health service use (38.1%), and 34.3% of those with relatively poor physical functioning. More than two-fifths of those reporting a lifetime history of suicide attempts (42.7%) reported psychotic experiences.

Table 2 describes, for each non-psychotic psychiatric disorder, how the concurrent presence of psychotic experiences was associated with specialist mental health service use, use of psychological treatment, lifetime suicide attempt, and poor physical functioning. With the exception of the association of anxiety disorder with use of psychological treatment, all outcomes were more common in those with non-psychotic psychiatric disorders with concurrent psychotic experiences compared to those without. Among participants reporting psychiatric disorders with concurrent psychotic experiences, proportions with specialist mental health service use ranged from 14% among those reporting mild/moderate symptoms of CMD with psychotic experiences, to 57.6% among those reporting PTSD with psychotic experiences.

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Table 2. Frequencies and proportions for analysed outcomes for each PE-comorbidity

	N in category	Secondary mental health service use[a]	Use of psychological treatment services[a]	Lifetime suicide attempt	Poor physical functioning[b]
CMD symptoms[c]					
Neither	941	74 (7.5)	92 (9.5)	35 (3.6)	84 (8.3)
PE and no CMD	136	23 (16.8)	19 (14.1)	10 (7.3)	14 (9.5)
No PE and mild/moderate CMD	114	24 (20.6)	27 (23.6)	14 (11.7)	42 (35.7)
PE and mild/moderate CMD	55	8 (14.0)	7 (11.7)	10 (17.6)	17 (29.6)
No PE and severe CMD	87	18 (21.0)	23 (26.1)	14 (15.9)	42 (47.5)
PE and severe CMD	83	38 (45.6)	21 (25.3)	26 (31.0)	55 (64.5)
Depressive episode[d]					
Neither	1046	95 (8.8)	119 (11.1)	48 (4.4)	127 (11.4)
Depressive episode only	96	21 (21.4)	23 (23.2)	15 (15.5)	41 (41.3)
PE only	207	39 (18.3)	29 (13.9)	25 (11.8)	40 (18.0)
Depressive episode with PE	67	30 (45.1)	18 (26.7)	21 (31.1)	46 (67.4)
Anxiety disorder[d]					
Neither	1058	99 (9.0)	123 (11.3)	57 (5.2)	144 (12.8)
Anxiety disorder only	84	17 (20.1)	19 (22.7)	6 (6.8)	24 (28.3)
PE only	228	55 (23.7)	39 (16.8)	36 (15.3)	67 (27.7)
Anxiety disorder with PE	46	14 (29.4)	8 (17.2)	10 (21.2)	19 (38.8)
PTSD[e]					
Neither	1105	107 (9.4)	133 (11.8)	56 (4.9)	151 (12.9)
PTSD only	37	9 (23.7)	9 (24.0)	7 (18.2)	17 (44.9)
PE only	239	49 (19.9)	32 (13.3)	31 (12.5)	62 (24.1)
PTSD with PE	35	20 (57.6)	15 (41.9)	15 (42.8)	24 (67.3)
PD[f]					
Neither	1023	90 (8.4)	115 (10.9)	42 (3.9)	130 (12.0)
PD only	119	26 (21.7)	27 (23.3)	21 (17.0)	38 (30.1)
PE only	195	39 (19.5)	28 (14.3)	24 (11.8)	48 (23.1)
PD with PE	79	30 (37.6)	19 (23.4)	22 (27.5)	38 (46.1)

[a]Based on linkage to databases for specialist mental health records including secondary mental health services and use of psychological treatment services.
[b]Binary indicator based on the lowest quartile of the physical component score on the SF-12.
[c]Based on scores on the Clinical Interview Schedule-Revised (CIS-R).
[d]Derived from items on the CIS-R.
[e]Derived from the PC-PTSD with a cut-off of 3.
[f]Derived from the SAPAS.

Use of psychological treatment among those with psychiatric disorders concurrent with psychotic experiences ranged from 11.7% among those with mild/moderate symptoms of CMD and psychotic experiences to 41.9% among those with PTSD and psychotic experiences. The proportion reporting lifetime suicide attempt among those with concurrent psychiatric disorders with psychotic experiences ranged from 17.6% among those reporting mild/moderate symptoms of CMD with psychotic experiences, to 42.8% in those with PTSD with psychotic experiences. The proportion of those experiencing poor physical functioning ranged from 29.6% of those with mild/moderate symptoms of CMD with psychotic experiences to 67.4% of those with depressive episode and psychotic experiences.

Table 3 displays adjusted associations of each non-psychotic psychiatric disorder with specialist mental health service use, use of psychological treatment, lifetime suicide attempt and poor physical functioning. All comparisons are made to the group without psychotic experiences and each non-psychotic psychiatric disorder. The associations of concurrent psychotic experiences with secondary mental health service use ranged from ORs

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Table 3. Estimates for the association (ORs and 95% CIs) of psychotic experiences (PE) concurrent with other mental disorders on public mental health, estimated from survey-weighted logistic regression models with additive interaction terms

	Secondary mental health service use[a]	Use of psychological treatment services[a]	Lifetime suicide attempt	Poor physical functioning
PE with CMD symptoms[b]				
No PE or CMD	Reference	Reference	Reference	Reference
PE and no CMD	**2.92 (1.80–4.74)**	**1.80 (1.06–3.03)**	**2.33 (1.10–4.95)**	1.78 (0.93–3.38)
No PE and mild/moderate CMD	**2.97 (1.80–4.91)**	**2.70 (1.67–4.37)**	**3.26 (1.71–6.21)**	**7.70 (4.69–12.65)**
PE and mild/moderate CMD	**2.24 (1.04–4.83)**	1.24 (0.56–2.73)	**5.96 (2.69–13.19)**	**8.06 (4.13–15.72)**
No PE and severe CMD	**3.04 (1.62–5.70)**	**2.90 (1.72–4.89)**	**4.31 (2.07–8.98)**	**13.14 (7.67–22.52)**
PE and severe CMD	**11.04 (6.63–18.38)**	**3.05 (1.73–5.37)**	**13.19 (7.14–24.35)**	**32.95 (18.49–58.69)**
ICR[c] for PE and mild/moderate CMD	−2.65 (−5.24 to −0.07)	−2.26 (−4.12 to −0.40)	1.37 (−3.47 to 6.21)	−0.42 (−6.38 to 5.54)
ICR for PE and severe CMD	6.09 (0.53–11.64)	−0.65 (−2.92 to 1.62)	7.55(−0.13 to 15.23)	19.02 (0.80–37.25)
LRT *p* value for interaction	*0.0107*	0.0532	0.6611	0.2023
PE with depressive episode[d]				
No PE or depressive episode	Reference	Reference	Reference	Reference
Depressive episode only	**2.52 (1.47–4.30)**	**2.14 (1.28–3.57)**	**3.36 (1.76–6.43)**	**6.36 (4.03–10.02)**
PE only	**2.73 (1.82–4.10)**	1.43 (0.92–2.20)	**3.22 (1.89–5.48)**	**2.57 (1.64–4.01)**
PE with depressive episode	**9.04 (5.23–15.63)**	**2.76 (1.54–4.97)**	**10.70 (5.62–20.37)**	**21.49 (11.63–39.73)**
ICR for PE and depressive episode	4.79 (−0.15 to 9.73)	0.20 (−1.72 to 2.12)	5.12 (−1.47 to 11.71)	13.57 (0.77–26.36)
LRT *p* value for interaction	0.532	0.8032	0.9775	0.5479
PE with anxiety disorder[d]				
No PE or anxiety episode	Reference	Reference	Reference	Reference
Anxiety disorder only	**2.57 (1.42–4.64)**	**2.12 (1.22–3.68)**	1.22 (0.51–2.92)	**3.39 (1.87–6.15)**
PE only	**3.68 (2.56–5.29)**	**1.72 (1.16–2.57)**	**3.72 (2.29–6.03)**	**3.84 (2.62–5.63)**
PE with anxiety disorder	**4.78 (2.53–9.04)**	1.65 (0.75–3.62)	**5.42 (2.50–11.77)**	**6.63 (3.40–12.94)**
ICR for PE and anxiety disorder	−0.47 (−3.85 to 2.92)	−1.20 (−3.07 to 0.67)	1.48 (−2.81 to 5.78)	0.40 (−4.21 to 5.02)
LRT *p* value for interaction	0.1742	0.1284	0.7876	0.1794
PE with PTSD[e]				
No PE or PTSD	Reference	Reference	Reference	Reference
PTSD only	**2.58 (1.16–5.73)**	1.90 (0.87–4.16)	**3.35 (1.41–7.94)**	**5.35 (2.64–10.84)**
PE only	**2.73 (1.87–3.98)**	1.27 (0.83–1.92)	**3.05 (1.86–4.98)**	**3.14 (2.17–4.54)**
PE with PTSD	**15.95 (7.42–34.3)**	**5.46 (2.64–11.31)**	**17.83 (8.13–39.09)**	**23.54 (11.07–50.08)**
ICR for PE and PTSD	11.65 (−0.52 to 23.81)	3.30 (−0.89 to 7.48)	12.44 (−1.26 to 26.13)	16.15 (−1.41,33.71)
LRT *p* value for interaction	0.1579	0.1242	0.4071	0.5043
PE with PD				
No PE or PD	Reference	Ref	Ref	Ref
PD only	**2.72 (1.62–4.60)**	**2.34 (1.45–3.79)**	**4.54 (2.48–8.31)**	**3.28 (2.10–5.14)**
PE only	**2.97 (1.96–4.49)**	1.49 (0.96–2.33)	**3.77 (2.16–6.59)**	**3.11 (2.03–4.75)**
PE with PD	**7.52 (4.41–12.80)**	**2.52 (1.44–4.42)**	**9.01 (4.86–16.68)**	**9.54 (5.71–15.94)**
ICR for PE and PD	2.82 (−1.22 to 6.87)	−0.32 (−2.13 to 1.50)	1.69 (−3.76 to 7.15)	4.15 (−0.54 to 8.84)
LRT *p* value for interaction	0.8981	0.569	0.137	0.8118

All estimates are adjusted for age, gender, and ethnic group.
[a]Based on linkage to databases for specialist mental health records including secondary mental health services and use of psychological treatment services.
[b]CMD symptoms based on categorisation of CIS-R score into three groups: 0–11 (no CMD), 12–18 (mild/moderate CMD), and over 18 (severe CMD).
[c]ICR: interaction contrast ratio, quantifying interaction on the additive scale.
[d]Derived from items on the CIS-R.
[e]Derived from the PC-PTSD with a cut-off of 3.
[f]Derived from the SAPAS.
[g]Binary indicator based on the lowest quartile of the physical component score on the SF-12.

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of 2.24 [95% confidence interval (CI) 1.04–4.83] for mild/moderate symptoms of CMD with psychotic experiences to 2.91(95% CI 1.37–6.19) for PD with psychotic experiences. Associations of psychiatric disorders with psychotic experiences and psychological treatment ranged from an OR of 1.24 (95% CI 0.56–2.73) in those with mild/moderate symptoms of CMD with psychotic experiences to 5.46 (95% CI 2.64–11.31) in those with psychotic experiences and PTSD. Associations with lifetime suicide attempt ranged from an OR of 5.42 (95% CI 2.50–11.77) among those with psychotic experiences with anxiety disorder to 17.83 (95% CI 8.13–39.09) in those with psychotic experiences with PTSD. Associations of concurrent psychotic experiences with poor physical functioning ranged from an OR of 6.63 (95% CI 3.40–12.94) for psychotic experiences with anxiety disorder to 23.54 (95% CI 11.07–50.08) for psychotic experiences with PTSD. Statistical evidence for interaction was found ($p = 0.01$) between psychotic experiences and CMD on specialist mental health service use with negative interaction between psychotic experiences and mild/moderate CMD (ICR: −2.65, 95% CI −5.24 to −0.07), and positive interaction between psychotic experiences and severe CMD (ICR: 6.09, 95% CI 0.53–11.64). Interaction between psychotic experiences and CMD displayed a similar pattern for use of psychological treatment, however there was insufficient statistical evidence of interaction ($p = 0.0532$). There was evidence of generally positive interaction on the additive scale between psychotic experiences and CMD for both lifetime suicide attempts and poor physical functioning. ICR point estimates suggested positive interaction for psychotic experiences with depressive episode for all outcomes, although statistical evidence was insufficient. We found indication of negative interaction between psychotic experiences and anxiety disorder on specialist mental health service use, and on use of psychological treatment, but not for lifetime suicide attempts and poor physical functioning. Large ICRs were observed for the interaction between psychotic experiences and PTSD for all outcomes, although all p values were greater than 0.05.

Table 4 shows the results of survival analysis of the association between non-psychotic psychiatric disorders with concurrent psychotic experiences and subsequent use of specialist mental health services, based on additive interaction terms. Compared to those without those symptoms, statistical associations were found for psychotic experiences concurrent with severe CMD and with depressive episode, PTSD, and PD, but not for mild/moderate CMD, or anxiety disorder. Estimates indicated a nearly four-fold increase in the rate of mental health service use for concurrent psychotic experiences with PTSD compared to those without psychotic symptoms or PTSD [hazard ratio (HR) 3.81, 95% CI 2.11–6.87], a 2.5-fold such increase in those with psychotic experiences concurrent with severe CMD (compared to those with neither symptoms of CMD nor psychotic experiences, HR 2.59, 95% CI 1.52–4.40), more than a two-fold increase in those with depressive episode concurrent with psychotic experiences (HR 2.29, 95% CI 1.33–3.94) compared to those without psychotic experiences or depressive episode, and a nearly two-fold such increase in those with psychotic experiences concurrent with PD (compared to those without psychotic experiences or PD, HR 1.03, 3.24).

Compared to those without those symptoms, statistical associations with time to use of psychological treatment were found for psychotic experiences concurrent with severe symptoms of CMD, depressive episode, PTSD, and PD. Estimates indicated a nearly three-fold increase in the rate of use of psychological treatment among those reporting PD with psychotic experiences, compared to those without these symptoms (HR 2.88, 95% CI 1.11–7.43), a nearly seven-fold increase in those reporting PTSD with psychotic experiences compared to those without (HR 6.80, 95% CI 3.18–14.54), a nearly six-fold increase among those reporting psychotic experiences concurrent with depressive episode (HR 5.90, 95% CI 3.11–11.18), and a similar increase among those reporting psychotic experiences concurrent with severe symptoms of CMD (HR 6.30, 95% CI 3.43–1.59). Inspection of ICR suggested statistical evidence of negative interaction on the additive scale between psychotic experiences and anxiety disorder on use of psychological treatment (ICR: −3.17, 95% CI −6.35 to 0.01, $p = 0.014$).

Discussion

Summary of findings

Consistent with previous literature (Linscott and van Os, 2013), this investigation of a representative urban community sample found psychotic experiences to be common (19.7%), and strongly associated with non-psychotic psychiatric disorders. We found that for each non-psychotic disorder, the presence of psychotic experiences greatly increased the odds of specialist mental health service use, psychological treatment for CMDs, lifetime suicide attempts, and impairment of physical functioning. In general, ICRs suggested positive synergy between psychotic experiences and non-psychotic psychiatric symptoms on public mental health need, with the exception of mild/moderate CMD and anxiety disorders.

The prevalence of psychotic experiences identified in this study falls within the highest decile of the distribution of previous prevalence reports based on meta-analysis (Linscott and van Os, 2013), and is considerably higher than the national prevalence of psychotic experiences based on a national survey of psychiatric morbidity carried out in 2007 (Koyanagi *et al.*, 2015). This is consistent with the greater prevalence of socioeconomic disadvantage, adversity, and substance use in densely populated urban areas compared to the rest of the population (Morgan *et al.*, 2014).

Previous literature

Frequent comorbidity between psychotic experiences and other psychopathology, including depression (Ohayon and Schatzberg, 2002), and anxiety (Wigman *et al.*, 2012), has been established in previous clinical and epidemiological studies. For example, in an analysis of four American general population datasets (DeVylder *et al.*, 2014*a*), psychotic experiences were markers of a greater number of psychiatric symptoms. A number of studies have also found psychotic experiences to be associated with adverse public health outcomes, including suicidal behaviours (Bromet *et al.*, 2017), functional impairment, and disability (Kelleher *et al.*, 2015; Navarro-Mateu *et al.*, 2017; Oh *et al.*, 2018). For example, in a non-representative sample of 212 adolescents (Kelleher *et al.*, 2015), meeting criteria for an Axis I psychiatric diagnosis and endorsing psychotic experiences was associated with worse functioning compared to those with a diagnosis not endorsing psychotic experiences. Based on a cross-national sample of nearly 200 000 adults, Koyanagi *et al.* (2016) found greater functional impairments in those with coexisting depressive episode and psychotic experiences, compared to those with depressive episode alone. In contrast to our study,

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Table 4. Prospective associations (HRs) and 95% CIs, for PE concurrent with CMDs and the rate of psychological treatment and the rate of contact with mental health services

	HR for use of psychological treatment[f] (95% CI)	HR for use of secondary mental health services[f] (95% CI)
PE with CMD symptoms[a]		
No PE or CMD	Reference	Reference
PE only	1.65 (1.00–2.72)	1.63 (0.76–3.49)
No PE with mild/moderate CMD	2.49 (1.59–3.90)	3.23 (1.78–5.87)
PE and mild/moderate CMD	1.19 (0.51–2.75)	2.36 (0.84–6.62)
No PE with severe CMD	2.86 (1.79–4.56)	1.84 (0.79–4.33)
PE and severe CMD	2.59 (1.52–4.40)	6.30 (3.43–1.59)
ICR for PE and mild/moderate CMD	−1.95 (−3.67 to −0.24)	−1.50 (−4.70 to 1.70)
ICR for PE and severe CMD	−0.93 (−2.83 to 0.98)	3.83 (−0.06 to 7.72)
LRT *p* value for interaction	0.0714	0.0861
PE with depressive episode[b]		
No PE or depressive episode	Reference	Reference
PE only	1.37 (0.90–2.08)	1.63 (0.90–2.96)
Depressive episode	2.33 (1.47–3.69)	1.73 (0.83–3.61)
PE with depressive episode	2.29 (1.33–3.94)	5.90 (3.11–11.18)
ICR	−0.41 (−2.03–1.22)	3.54 (−0.24 to 7.32)
LRT *p* value for interaction	0.4002	0.1695
PE with anxiety disorder[c]		
No PE or anxiety disorder	Reference	Reference
PE only	1.56 (1.07–2.27)	2.89 (1.76–4.75)
Anxiety disorder	1.85 (1.08–3.18)	3.06 (1.54–6.09)
PE with anxiety disorder	1.43 (0.67–3.06)	1.79 (0.58–5.50)
ICR	−0.97 (−2.54 to 0.59)	−3.17(−6.35 to 0.01)
LRT *p* value for interaction	0.1568	*0.0153*
PE with PTSD[d]		
No PE or PTSD	Reference	Reference
PE only	1.19 (0.80–1.79)	1.88(1.12–3.16)
PTSD	1.86 (0.95–3.66)	1.24 (0.36–4.29)
PE with PTSD	3.81 (2.11–6.87)	6.80 (3.18–14.54)
ICR	1.75 (−0.78 to 4.29)	4.68 (−0.60 to 9.96)
LRT *p* value for interaction	0.2371	0.1526
PE with PD[e]		
No PE or PD	Reference	Reference
PE only	1.54 (1.02–2.32)	2.27 (1.29–4.00)
PD	2.38 (1.52–3.72)	1.06 (0.82–1.37)
PE with PD	1.83 (1.03–3.24)	2.88 (1.11–7.43)
ICR	−1.09 (−2.63 to 0.45)	0.55 (−2.57 to 3.67)
LRT *p* value for interaction	0.1253	0.6089

All estimates are adjusted for age, gender, and ethnic group.
[a]CMD symptoms based on categorisation of CIS-R score into three groups: 0–11 (no CMD), 12–18 (mild/moderate CMD), and over 18 (severe CMD).
[b]ICR: interaction contrast ratio, quantifying interaction on the additive scale.
[c]Derived from items on the CIS-R.
[d]Derived from the PC-PTSD with a cut-off of 3.
[e]Derived from the SAPAS.
[f]Based on linkage to databases for specialist mental health records including secondary mental health services and use of psychological treatment services.

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they did not find association between reporting concurrent psychotic experiences and poor physical functioning.

However, few studies have examined the public mental health impact of intersection between psychotic experiences and non-psychotic psychiatric disorders, which is important based on the frequent overlap of psychotic experiences with other psychopathology. Kelleher *et al.* (2014) examined the prevalence of previous suicide attempts among Irish adolescents with psychiatric symptoms, comparing those reporting psychotic experiences to those not reporting psychotic experiences. Examining affective, behavioural and anxiety disorders, suicide attempts were associated with reporting concurrent psychotic experiences compared to experiencing these disorders without psychotic experiences. This study ascertained clinical diagnoses, in a relatively small group of help-seeking adolescents. In the general population based World Mental Health surveys, psychotic experiences were prospectively associated with attempted suicide (Bromet *et al.*, 2017), but investigators did not aim to examine the effect of psychotic experiences concurrent with other psychiatric symptoms or disorders on the outcome. In contrast to previous studies, we examine the influence of a comprehensive range of psychiatric disorders comorbid with psychotic experiences on outcomes of broad public mental health importance.

Studies on risk factors for psychotic experiences have typically *adjusted* for other psychopathology as potential confounding variables, that is, as common causes of both exposure and outcome, rather than assessing their implications in combination. For example, McGrath *et al.* (2017) examined the prospective relationship between traumatic experiences and psychotic experiences in the World Mental Health Surveys, finding increasingly strong associations between traumatic experiences, and increasing number of traumatic experiences, and subsequent psychotic experiences, after adjusting for PTSD and a range of other psychiatric disorders. By assessing additive interaction between psychotic experiences and non-psychotic psychiatric disorders, we were able to compare the association between symptom comorbidities with psychotic experiences on public mental health outcomes, giving an indication of the possible importance of psychotic experiences in a clinical context with other, commonly occurring psychiatric symptoms.

Limitations

We were able to assess the interaction between non-psychotic psychiatric disorders with comorbid psychotic experiences for a range of mental disorders (including temporally prospective specialist mental health service use and use of psychological treatment), and good statistical evidence was found for our main comparisons. Nevertheless, our inferences could have been affected by chance – some association estimates were based on small numbers of participants. Models were identically specified for each outcome, aiding comparison. However, some confounders could have applied to certain outcomes more strongly than others. We had no information on timings, frequency or intensity of psychotic experiences. Measurement accuracy may have been influenced by the simultaneous assessment of psychopathology in the same survey assessment, e.g. depressed mood may have influenced the accuracy of psychotic experiences assessment, and vice versa. Confounding by unknown, unmeasured, or poorly measured/misreported characteristics is possible. Responders to health surveys tend to be healthier than the general population (Keyes *et al.*, 2018), and so the true prevalence of mental health service use for comorbid psychotic experiences in the general population may be greater than that estimated here, although our analysis incorporated non-response weights which probably limited bias in estimates. Given the cross-sectional ascertainment of concurrent psychotic experiences, we were unable to identify or examine the temporal direction of associations between psychotic experiences and non-psychotic psychiatric disorders, although bi-directional relationships between psychotic experiences and other psychiatric disorders are evident in previous literature (McGrath *et al.*, 2016). We were also unable to analyse direction of causal association between psychotic experiences and suicide attempt, or impairment of physical functioning. Although our characterisation of non-psychotic psychiatric disorders was not based on clinical interviews, we were able to derive ICD-10 diagnoses from the rating of psychiatric symptoms, based on accepted algorithms.

Explanations

Our findings underline the importance of taking account of non-psychotic psychopathology when assessing the impact of psychotic experiences on mental health (Bhavsar *et al.*, 2018). The influence of psychotic experiences on help-seeking behaviour could be dependent on the other psychiatric symptoms that are experienced. For example, it is possible that psychotic experiences themselves are less severe in those with mild/moderate CMD compared to those with severe CMD, or that psychotic experiences raise the threshold at which individuals with mild/moderate CMD or anxiety seek help for mental disorders.

Frequent overlap between psychotic experiences and non-psychotic psychiatric disorders observed in the current study is consistent with a general psychopathological factor underlying psychiatric disorders, proposed by Caspi and supported by genetic, neuroimaging, and psychometric evidence (Klaassen *et al.*, 2013; Caspi *et al.*, 2014; Frangou, 2014). This continuity may also account for the occurrence of mood dysregulation during the development of psychosis, prior to onset of positive psychotic symptoms (Mishara and Fusar-Poli, 2013). Our results support the possibility that psychotic experiences are non-specific markers of overall psychopathology, and indicate that psychotic experiences may be a relevant predictor of greater symptom burden, in line with current understanding of psychosis as a more burdensome psychiatric disorder in its own right. Given the strong associations of psychotic experiences concurrent with non-psychotic psychiatric disorders with service use and suicide attempts measured in this study, it is possible that concurrent psychotic experiences explain some of the public mental health need attributable to common psychiatric disorders in the general population.

The presence of psychotic experiences in a clinical presentation may be a marker of greater subsequent mental health need (Bhavsar *et al.*, 2017), and our results indicate that this may also be true in the context of co-occurring non-psychotic psychiatric symptoms. Psychotic experiences could identify a higher risk group for population-based interventions to improve public mental health. The design of services could reflect the importance of psychotic experiences for the prognosis of CMDs, and symptoms of CMDs for the prognosis of psychotic conditions. Psychotic experiences could be a useful, relatively easy to measure indicator of later mental health need, which could be incorporated into prognostic tools for mental health service use at a population level, to guide commissioning of future services.

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